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EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

A9

Office Action Summary	Application No.	Applicant(s)	
	09/894,186	CHAN ET AL.	
	Examiner	**Art Unit**	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _19 November 2003_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-12_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-12_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-2, 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103).

Bernardi discloses a reactor under a hydrogen flow maintained at atmospheric pressure (col 3, ln 35-40) and a growth solution at a temperature of 485°C, this reads on applicant's temperature above the saturation temperature, and by reducing to the solution temperature of 470°C a crystal layer is deposited on a substrate, this reads on applicant's temperature at or below the saturation temperature (col 5, ln 40-67). Bernardi also discloses at a 2 or 3 degree lower temperature for a supersaturation condition allowing growth to start is obtained (col 5, ln 45-55 and Fig 3). Bernardi teaches a reactor (Abstract), this reads on applicant's chamber.

Bernardi discloses lowering temperature to achieve a supersaturation condition. Bernardi does not disclose varying pressure to bring the solution to supersaturation.

In a solution growth method for synthesizing crystals, Dugger teaches the degree of supersaturation can be changed by changes in the pressure of the solution or controlled by a temperature of the solution (col 3, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Bernardi with Dugger's pressure change to

bring the solution to supersaturation because operating isothermally avoids undesirable temperature gradients in the melt forming crystals on the sidewalls of the reactor.

The combination of Bernardi and Dugger does not teach uniformly varying pressure by varying the pressure of a non-growth source constituent gas. It is conventionally known in the art to uniformly pressurize a vessel with an inert gas, this reads on applicant's non-growth source constituent gas, as evidenced by Omino (US 5,167,759) and Gault (US 4,521,272), below.

Referring to claim 1, the examiner interprets changes in the pressure of the solution to read on applicant's pressure of the system.

Referring to claim 9, the combination of Bernardi and Dugger teaches a temperature of 470°C and varying pressure to achieve supersaturation at 470°C.

3. Claims 3-4, 6-7 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103) as applied to claims 1-2 above, and further in view of Cook (US 4,519,871).

The combination of Bernardi and Dugger teaches all of the limitations of claim 3, as discussed previously in claims 1 and 2, except providing a second growth solution.

In a method of liquid phase epitaxy, Cook teaches a first solution is contacted with a substrate in a channel and an epitaxial layer of a first composition is grown to a desired thickness by liquid phase epitaxy and a second solution, separate from the first solution in then brought in contact with the substrate by moving a bubble across the substrate, thereby sweeping the first solution away and an epitaxial layer of a second composition is then grown on the substrate to a desired thickness by liquid phase epitaxy. Cook also discloses the process can be continued until

the desired number of epitaxial layers have been grown of the substrate (col 1,ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bernardi and Dugger with Cook's second growth solution because it produces superlattice semiconductor structures for use in electronic and optoelectronic devices (col 1, ln 1-5).

Referring to claim 4, the combination of Bernardi, Dugger and Cook teaches repeating the process of contacting the substrate with the first and second growth solution until a desired thickness is achieved.

Referring to claim 6, the combination of Bernardi, Dugger and Cook teaches a first growth solution, a second growth solution and a substrate at atmospheric pressure and heating the growth solutions above a saturation temperature and cooling to below the saturation temperature and varying pressure to control the degree of supersaturation, where a bubble moves the first solution out of contact of the substrate prior to contact with the second solution.

Referring to claim 7, the combination of Bernardi, Dugger and Cook teaches repeating the process of contacting the substrate with the first and second growth solution until a desired thickness is achieved.

4. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103) as applied to claims 1-2 above, and further in view of Hsieh (US 4,142,924).

The combination of Bernardi and Dugger teaches all of the limitations of claim 10, as discussed previously in claims 1-2. The combination of Bernardi and Dugger teaches the deposition of mercury cadmium telluride layers, which is not a III-V epitaxial layer.

In a liquid epitaxy method for growing thin films, Hsieh teaches layers of III-V compounds can be formed from liquid phase epitaxy, where III-V semiconductors include GaSb (col 5, ln 5-20). Hsieh also teaches a GaAs wafer **6**, a supersaturated solution of GaAs **8** and the substrate is contacted with the solution to grow a thin film of GaAs on the GaAs wafer at 800°C (col, 3, ln 1-35 and col 2, ln 50-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bernardi and Dugger with Hsieh's growth solution of III-V semiconductor compounds because III-V semiconductors are useful in the opto-electronics industry.

Referring to claim 11, the combination of Bernardi, Dugger and Hsieh teaches GaSb.

5. Claims 1 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573).

Hsieh discloses a liquid phase epitaxy growth of GaAs on a GaAs substrate **6** from a solution of GaAs **8**, where the growth is carried out under flowing H_2 (col 2, ln 50-67). Hsieh also discloses the solution and the substrate are heated in an oven substantially above their equilibrium temperature, this reads on applicant's saturation temperature, and the solution and substrate are then cooled in the oven to a temperature below the solution equilibrium temperature, where substrate contacts the solution to form a thin layer of GaAs on the GaAs substrate at a temperature of 800°C (col 3, ln 5-60). Hsieh also teaches layers of III-V

compounds can be formed from liquid phase epitaxy, where III-V semiconductors include GaSb (col 5, ln 5-20). Hsieh teaches a LPE apparatus, this reads on applicant's chamber, for growing a semiconductor epitaxial layers (Fig 1 and col 2, ln 35-68).

Hsieh is silent to varying the pressure of the system to change the degree of supersaturation of the growth solution.

In a solution growth method for synthesizing crystals, Dugger teaches the degree of supersaturation can be changed by changes in the pressure of the solution or controlled by a temperature of the solution (col 3, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Hsieh with Dugger's pressure change the degree of supersaturation because control of the supersaturation prevents homogeneous nucleation in the solution, which prohibits growth on a substrate.

The combination of Hsieh and Dugger does not teach uniformly varying pressure by varying the pressure of a non-growth source constituent gas. It is conventionally known in the art to uniformly pressurize a vessel with an inert gas, this reads on applicant's non-growth source constituent gas, as evidenced by Omino (US 5,167,759) and Gault (US 4,521,272), below.

Referring to claim 1, the examiner interprets the changing of the pressure of the solution to read on applicant's pressure of the system.

Referring to claim 8, the combination of Hsieh and Dugger teaches a temperature of 800°C.

Referring to claim 9, the combination of Hsieh and Dugger teaches a temperature of 800°C.

Referring to claim 10, the combination of Hsieh and Dugger teaches GaSb, a group III-V semiconductor.

Referring to claim 11, the combination of Hsieh and Dugger teaches GaSb.

6. Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573) as applied to claim1 above, and further in view of Bernardi (US 4,906,325).

The combination of Hsieh and Dugger teaches all of the limitation of claim 2, as discussed previously in claim 1, except the growth solution and substrate are provided at atmospheric pressure. The combination of Hsieh and Dugger teaches a flow of H_2 is flowed during the growth process but is silent to the pressure.

In a method of forming thin films from solution, Bernardi teaches a hydrogen flow is maintained under atmospheric pressure in order to avoid an oxidative phenomena (col 3, ln 35-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hsieh and Dugger with Bernardi's hydrogen pressure of atmospheric pressure because it avoids oxidation.

Referring to claim 5, the combination of Hsieh, Dugger and Bernardi teaches a first growth solution and substrate under a flow of H_2 at atmospheric pressure and heating to above a saturation temperature and cooling to below the saturation temperature and maintaining at 800°C while varying pressure to control the degree of supersaturation and contacting the substrate with the solution thereby forming a thin film, i.e. solid layer.

7. Claims 3-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573) along with Bernardi (US 4,906,325) as applied to claim 2 above, and further in view of Cook (US 4,519,871).

The combination of Hsieh, Dugger and Bernardi teaches all of the limitations of claim 3, as discussed previously, except a second growth solution.

In a method of liquid phase epitaxy, Cook teaches a first solution is contacted with a substrate in a channel and an epitaxial layer of a first composition is grown to a desired thickness by liquid phase epitaxy and a second solution, separate from the first solution in then brought in contact with the substrate by moving a bubble across the substrate, thereby sweeping the first solution away and an epitaxial layer of a second composition is then grown on the substrate to a desired thickness by liquid phase epitaxy. Cook also discloses the process can be continued until the desired number of epitaxial layers have been grown of the substrate (col 1,ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hsieh, Dugger and Bernardi with Cook's second growth solution because it produces superlattice semiconductor structures for use in electronic and optoelectronic devices (col 1, ln 1-5).

Referring to claim 4, the combination of Hsieh, Dugger, Bernardi and Cook teaches varying pressure of a second growth solution controls the degree of supersaturation.

Referring to claim 5, the combination of Hsieh, Dugger, Bernardi and Cook teaches heating above an equilibrium temperature, this reads on applicant's saturation temperature under atmospheric pressure and setting the temperature below the saturation temperature and varying

the pressure to control the degree of supersaturation and contacting a substrate with a growth solution, thereby depositing a thin film, i.e. solid layer.

Referring to claim 6, the combination of Hsieh, Dugger, Bernardi and Cook teaches heating above an equilibrium temperature, this reads on applicant's saturation temperature under atmospheric pressure and setting the temperature below the saturation temperature and varying the pressure to control the degree of supersaturation and contacting a substrate with a growth solution, thereby depositing a thin film, i.e. solid layer. The combination of Hsieh, Dugger, Bernardi and Cook also teaches a first growth solution is moved from the substrate by a bubble, this reads on applicant's moving the substrate out of contact with the first growth solution.

Referring to claim 7, the combination of Hsieh, Dugger, Bernardi and Cook teaches repeating steps until a desired thickness is achieved.

Referring to claim 8, the combination of Hsieh, Dugger, Bernardi and Cook teaches a temperature of 800°C.

Referring to claim 9, the combination of Hsieh, Dugger, Bernardi and Cook teaches a constant temperature.

Referring to claim 10, the combination of Hsieh, Dugger, Bernardi and Cook teaches GaAs a group III-V semiconductor.

Referring to claim 11, the combination of Hsieh, Dugger, Bernardi and Cook teaches GaSb.

Response to Arguments

8. Applicant's arguments filed 11/19/2003 have been fully considered but they are not persuasive.

Applicant's argument that Dugger does not teach a crystal growth method by varying the pressure is noted but is not found persuasive. Applicants allege that Dugger merely alludes to the fact that the degree of supersaturation of a solution may be affected by a number of standard thermodynamic parameters. The Examiner agrees that Dugger does teach using a variety of thermodynamic parameters to change the degree of supersaturation of solution, as alleged by applicant. However, the Dugger does teach changing the pressure and solute crystallizes out of the solution (col 3, ln 15-21), which is a teaching of crystal growth. Therefore, Dugger does teach changing pressure.

In response to applicant's argument that Dugger is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Dugger teaches a method of changing the degree of supersaturation of a solution, which is used in a crystallization process (col 3, ln 15-21), which is related to the teachings of Bernardi and Hsieh, which teaches growth of crystal layers from a supersaturated solution. Furthermore, the teachings of Dugger are not limited to bulk single crystals, as alleged by applicant. Dugger teachings are related to solution growth in general, which is not limited to bulk crystals (col 2, ln 66 to col 3, ln 21) and merely discloses preferred embodiments of growing bulk crystals. Also, a person of ordinary skill in the art at the time of the invention would have found it obvious to use known thermodynamic

parameters, which relate to supersaturation taught by Dugger in other process, which relate to supersaturation of a solution, such as epitaxial layer growth.

Applicant's arguments regarding the Liao reference are noted but are not found persuasive. The Liao reference is merely provided as an additional reference, which teaches pressure can be used to change the degree of supersaturation and is not incorporated into the rejection. However, the Examiner will address of the issues raised by applicant. Applicants allege that Liao does not teach varying the pressure to change the degree of supersaturation. Liao teaches **applying** a pressure to obtain a supersaturated solution (col 4, ln 50-55), which inherently requires a change in a pressure, which reads on varying because the pressure is raised to obtain the supersaturated solution because applying requires the addition of more pressure resulting in a change or variance in pressure.

In response to applicant's argument that Liao is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Liao teaches liquid phase crystal growth method by applying a pressure to obtain a supersaturated solution ([0026]), which is related to the teachings of Bernardi and Hsieh, which teaches growth of crystal layers from a supersaturated solution. A person of ordinary skill in the art at the time of the invention would have found it obvious to use known thermodynamic parameters, which relate to supersaturation taught by Liao in other process, which relate to supersaturation of a solution, such as epitaxial layer growth.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Applicant's argument that it is not "apparent" to use pressure is noted but is not found persuasive. Applicants allege that there is specific teaching of pressure control to grow an epitaxial layer since the Dugger reference. If a reference did exist, this would be the basis of an anticipation rejection under USC 102, which is not made. The current rejection is made under USC 103, which relates to obviousness. The argument made by applicant is not applicable to an obviousness-type rejection. The Examiner has provided a reference, Dugger, which teaches the use of pressure to change the degree of supersaturation of solution or by using temperature. The Examiner has also provided motivation to one of ordinary skill in the art at the time of the invention to apply the teaching of Dugger to the conventional process taught by Hsieh and Bernardi. Therefore, a proper case of prima facia case of obviousness has been established.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Omino (US 5,167,759) teaches a crucible is placed in a high pressure vessel and the vessel is pressurized with an inert gas and a crystal is allowed to grow (col 1, ln 40-50).

Gault (US 4,521,272) teaches a container is positioned in an apparatus and is pressurized to a desired pressure with an inert gas (col 5, ln 50-65).

Liao (EP 0 922 488 A2) teaches a solution of a supersatured state can be obtained using a conventional method, for example, cooling a solution or applying a pressure to a solution [0026].

Porowski et al (US 5,637,531) teaches a method of making a crystalline structure at two pressures, where the lower pressure results in a slower growth rate (Abstract).

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

Nadine Norton